

CLAIMS

1. A safety/confinement device for storing, transporting or handling a dangerous and/or potentially-reactive product in an environment of industrial dimensions at essentially ambient atmospheric pressure and temperature, said device comprising:
 - a reservoir for housing the product therein ;
 - an envelope inside the reservoir, the envelope being designed to protect the product from any contact with atmospheric oxygen, even in the event of rupture of the reservoir structure, and
 - means to delay or prevent the spillage of said product out into the air, particularly in the event of accidental impact or unforeseen heat exposure from a neighbouring fire.
2. The device of claim 1, comprising at least one permeable membrane capable of selective sorption, dissolution or diffusion to enable the extraction of potentially hazardous vapors and gases contained in at least one element of the device.
3. The device of claim 1, comprising at least one selective permeable membrane to enable injection of an inhibitor/stabilizer into the product or into its vapors, or of an inert gas used to flush out and/or ventilate empty spaces of the reservoir and other elements of said device.
4. The device of claim 1, comprising means for generating and for injecting into the reservoir, around an envelope containing the product and/or around at least one inflatable cushion of the "airbag" type or around another component, of fire-retardant foam, self-solidifying or not, incombustible and inert with regard to the stored product, contributing towards protecting the envelope and making it leak-proof, by physically and thermally shielding the product from the walls and from the surroundings.
5. The device of claim 1, comprising at least one safety valve controlling the product inlet and/or outlet from an element of said device or the entry of ambient air in the event of failure of the distribution system or rupture of its outside connection.
6. The device of claim 1, comprising an element equipped with at least one mechanism located at one of the inlets and/or the outlets of an envelope containing the stored product to close the orifices of the envelope by sealing them shut, as well as those of an inflatable cushion of the "airbag" type enclosing it, while freeing them loose from the walls of the reservoir.

7. The device of claim 1, wherein at least one of the elements containing the product comprises an impermeable envelope, deformable or not, containing the product.
8. The device of claim 7, wherein the envelope in which is contained the dangerous product comprises an element which displays at least one of the characteristics selected from the group comprising:
 - being impermeable and chemically inert, especially with respect to the stored product, to its vapours, and to its self-reaction, decomposition and/or degradation by-products, to the chemical or biological impurities which it may contain, to the air or to another ambient reagent, the envelope preferably including one or several layers of various, appropriate non-permeable materials,
 - being impact-resistant mechanically, to perforation and/or to tearing, for example by being made of two or more layers of material in which are eventually incorporated mesh or fibres of "nylon", glass, carbon, "Kevlar", metallic and/or synthetic, woven or not,
 - tolerating temperatures varying from minus 50 degrees Celsius to plus 900 degrees Celsius, preferably from minus 50 to plus 150 degrees Celsius, and
 - being relatively insensitive to solar radiation, especially for cases where the envelope is liable to be exposed to them for long periods, for example when it contains a product stored in bulk.
9. The device according to claim 8, including micro and/or nano sensors to detect the envelope's condition and characteristics, notably of an autonomous wireless type or connected for instance by optical fibre(s) to a control, , monitoring and command centre for activating means of intervention of the device.
10. The device according to claim 7, wherein that the envelope is itself completely enclosed by at least one inflatable watertight cushion of the "airbag" type.
11. The device according to claim 10, wherein the inflating of at least one component of the "airbag" type, at the time of its activation, is ensured via an inert and incombustible gas, such as nitrogen or argon for fuels, especially non-reactive in relation to the stored product and to its decomposition products.
12. The device of claim 1, comprising means to control the stability and/or the initial reactivity of the product, to ensure continual monitoring of its dangerousness, especially its composition, its age, its aging rate and such parameters as its temperature and the concentration of the most

significant reagents, in order to activate, manually or automatically, using predetermined values, alarm and intervention means, such means of intervention especially enabling to correct, as needed, the physical or chemical parameters required to avoid an uncontrollable runaway reaction.

13. The device of claim 1, wherein the reactive or dangerous product contained within includes at least one of the products selected from the group comprising: fuels, especially hydrocarbons, carbohydrates and hydrogen, organic materials, oxidizing agents, especially oxygen and peroxides, chemical substances liable to ignite/explode spontaneously when brought into contact with ambient air, or products of a toxic and/or polluting nature for the ambient environment.
14. The device of claim 1, comprising means to ensure several levels of confinement adapted to the product or to the risks of accidental aggression linked to the environment or the conditions of use, such means preferably including the successive elements surrounding an envelope containing the product, the layers of which each provides an added level of chemical, physical, thermal and/or mechanical protection to the dangerous product contained within, in addition to the envelope.
15. The device of claim 1, including at least one detector and/or a sensor, and/or a detector that is part of a microcomputer, having the task of transmitting data to a central processing unit or to a control centre, especially via wireless liaison and/or via fibre optics.
16. The device of claim 1, including means of intervention capable of being implemented in accordance with the data transmitted by the detectors or sensors, and/or the sensors that are a part of a microcomputer, in order to overcome the risks incurred.
17. The device of claim 1, including at least a means for recovering gases, reactive and/or toxic substances, flammable vapours of a hazardous, toxic and/or polluting nature, extracted from an element of the device, especially from the envelope, in order to temporarily store them safely, condense, recycle or neutralize them, should there be a risk of self-ignition or explosion or of accidental release into the environment.
18. The device of claim 1, wherein the envelope has at least one high point so that bubbles, vapours or gases present in the stored product tend to accumulate in such a high point.

19. The device of claim 1, including means for evacuating the gases and/or the accumulated vapours, especially in a high point of an envelope or of a product transfer/distribution element, in order to, for example, collect them, direct them to safe storage, stabilize them, neutralize or burn them in a controlled manner, for example in a motor or a flare, or to reinject them back into the product or into a distribution circuit.
20. The device of claim 1, comprising means to at least carry out one of the following operations:
 - monitor the product's temperature and compare it with at least one value set by the operator,
 - cool the product to the prescribed level needed to ensure that the safety margin imposed relative to the ambient risk of an accidental energy influx exceeding the amount required for self-ignition/explosion,
 - control the stability of the product,
 - detect the presence of hazardous vapours, especially flammable and/or explosive, in the elements of the device located outside an envelope containing the product, and evaluate their danger according to their temperature and their concentration, along with those of the oxygen and/or other reagents, and
 - compare the measured values with the pre-determined values in order to open or to close at least one valve or one gate and/or to particularly activate means for filling/emptying, for inflating, for flushing out, for ventilating, for injecting neutralising products, for cooling off and for collecting.
21. The device of claim 1, comprising means to at least carry out one of the following operations:
 - detecting an impact,
 - identifying a leakage of the product contained in the envelope,
 - detecting and measuring an increase in the temperature of the product, and/or of the walls of the reservoir and of those of any other element(s) of the device,
 - monitoring the duration of storage of the product and the conditions under which it is stored, and comparing the said duration with a deadline eventually prescribed by the operator,
 - evaluating its level and/or its rate of aging.
22. The device of claim 1, comprising at least one sensor such as piezoelectric fibres included in the wall of a component of the "airbag" type, and means such as a valve, in order to prevent the "airbag" type component from inflating to a pressure exceeding the specifications of the reservoir's structures, and then preventing it from deflating once the desired volume has been

reached in order to ensure optimal protection of an envelope containing the product as well as of the stored product.

23. An application of the device of claim 1 to a land, air, space, maritime or river vehicle.
24. An application of the device of claim 1 to storage, to transfer, to transport, to handling bulk products, packed or not, and/or in an open space, or a confined or semi-confined reservoir.
25. Application of the device of claim 1 to storage, to transfer, to transport or to handling a product that is in gas or liquid form, especially vapours, mist, droplets or solids, for example as particles, grains, granules, powder, dust, flour, chips, fibres, sheets or porous material.